

Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases

**Montana Department of
Environmental Quality**

October 2003

Table of Contents

Definitions and Acronyms	ii
Overview of Risk-Based Corrective Action	1
RBCA Focuses on Risk Evaluation	1
Chemicals of Concern.....	1
Exposure Pathways	2
Remedial Actions Under RBCA.....	2
Tier 1 Data Collection and Evaluation	3
Documenting Site Conditions.....	3
Soil Sampling Requirements.....	4
Groundwater Sampling Requirements.....	5
The Tier 1 Evaluation	6
Summary of Tier 1 Procedures	7
Development of Tier 1 Lookup Tables.....	8
Derivation of RBSLs.....	9
Models Used to Generate Tier 1 RBSLs	10

List of Tables

Table A - Soil Sampling Requirements.....	5
Table B - Groundwater Sampling Requirements.....	6
Table 1 - Surface Soil RBSLs.....	12
Table 2 - Subsurface Soil RBSLs.....	13
Table 3 - Groundwater RBSLs.....	14

List of Figures

Figure 1 - Tier 1 Procedures Flowchart.....	11
---	----

Appendices

Appendix A – 24-Hour and 30-Day UST Release Reports	
Appendix B – Enforcement Division Complaint/Spill Report	
Appendix C – Master Table of Potential Tier 1 Values	
Appendix D – Vadose Zone Modeling Technical Support Document	
Appendix E – Direct Contact Technical Support Document	
Appendix F – Technical Memorandum on Application of the Massachusetts Method in Facility Characterization	

Definitions and Acronyms

ARM - Administrative Rules of Montana.

BTEX - Benzene, toluene, ethylbenzene, and xylenes

Carcinogen - A compound that the EPA has determined causes cancer based on the weight of peer-reviewed scientific evidence. Some carcinogens may also have non-carcinogenic effects.

Chemicals of concern (COCs) - Specific petroleum compounds that are identified for evaluation in a RBCA evaluation or a risk assessment.

Circular WQB-7 - The Montana Numerical Water Quality Standards, applicable to state surface water and groundwater, adopted by rule and published by DEQ.

Closed petroleum release - A classification indicating no further corrective action is required to address a petroleum release because all remediation requirements for the release have been completed.

COC - See chemicals of concern.

Commercial/industrial property - Property used as a place of business with employees present regularly on a typical five days on, two days off schedule with no one living on the property.

Corrective action - Actions at a petroleum release that may include, but are not limited to, investigation, site assessment, emergency response, abatement, underground storage tank removal, cleanup, operation and maintenance of equipment, monitoring, reclamation, and termination of the corrective action. Also known as remedial action.

DEQ - The Montana Department of Environmental Quality.

Diesel range organics (DRO) - Non-target compounds found in diesel. DRO is also the analytical method used to determine the concentrations of these non-target compounds (DEQ has replaced the DRO analysis with EPH).

DRO - See diesel range organics.

EPA - The United States Environmental Protection Agency.

EPH - See extractable petroleum hydrocarbons.

Excavation/construction scenario - An exposure scenario based on the limited exposure of individuals to subsurface soils during an excavation to install piping, utilities, other underground features, shrubs, or trees.

Exposure - The contact of a receptor with a COC.

Exposure pathway - The route a chemical or physical agent takes from a source to an exposed receptor. An exposure pathway describes a unique mechanism by which an individual or population is exposed to chemicals of concern at or originating from a release. Each exposure pathway includes a source, an exposure point, and an exposure route. If the exposure point differs from the source, a transport/exposure medium (e.g., air) or media (in cases of transfer between media) will also be included.

Examples of complete exposure pathways include:

- ♦ Inhalation of vapors from impacted soils by a person on site.
- ♦ Impacted soils leaching into potable groundwater and being used by a nearby resident for drinking and bathing.
- ♦ Inhalation of vapors by a neighbor resulting from the migration of free product.
- ♦ Impacted groundwater discharging to wetlands or other surface water bodies.

Extractable petroleum hydrocarbons (EPH) - A group of petroleum hydrocarbons that includes the non-target petroleum fractions typically found in diesel and other heavier petroleum products. EPH is also the analytical method

developed by the Massachusetts Department of Environmental Protection to determine the fractional composition of these non-target compounds.

Free (phase) product - Petroleum product floating on the groundwater or surface water, occupying soil pore space, or on the ground surface. Also, petroleum products or other substances present as non-aqueous phase liquids.

Gasoline range organics (GRO) - Non-target compounds found in gasoline. GRO is also the analytical method used to determine the concentrations of these non-target compounds (DEQ has replaced the GRO analysis with VPH).

GRO - See gasoline range organics.

Hazard index (HI) - The sum of more than one hazard quotient for multiple substances and/or multiple exposure pathways.

Hazard quotient - The ratio of a single substance exposure level over a specified time period to a reference dose for that substance derived from a similar exposure period.

Impacted groundwater - Groundwater containing contaminants in concentrations that approach or exceed WQB-7 human health standards, narrative standards, or RBSLs for non-target compounds.

MBTEXN - Methyl tertiary-butyl ether, benzene, toluene, ethylbenzene, xylenes, and naphthalene.

MCA - Montana Code Annotated.

Methyl tertiary-butyl ether (MTBE) – A synthetic chemical added to most commercial gasolines as an anti-knock additive or oxygenate.

MNA – See monitored natural attenuation.

Monitored natural attenuation (MNA) – A scientific protocol for documenting monitoring requirements necessary to verify that natural processes are attenuating the transport of petroleum hydrocarbons in the environment.

MTBE -- See methyl tertiary-butyl ether.

Non-carcinogen – A compound that the EPA has determined to have toxic effects, but has not determined to be a carcinogen. Some carcinogens may also have non-carcinogenic effects.

PAHs - See polycyclic aromatic hydrocarbons.

Petroleum product - Gasoline, crude oil (except for crude oil at production facilities subject to regulation under Title 82 MCA), fuel oil, diesel oil or fuel, lubricating oil, oil sludge or refuse, and any other petroleum-related product or waste or fraction of the product or waste that is liquid at standard conditions of temperature and pressure (60 degrees F and 14.7 pounds per square inch absolute) (§75-10-701, MCA).

Petroleum release - A release of petroleum product into the environment, with “release” defined below (§75-10-701, MCA).

Polycyclic aromatic hydrocarbons (PAHs) - A group of petroleum hydrocarbons that includes several semivolatile compounds typically found in petroleum products, especially petroleum products that are heavier than diesel. (Also referred to as polynuclear aromatic hydrocarbons or PNAs.)

RBCA - See risk-based corrective action.

RBSL - See risk-based screening level.

Reasonably anticipated future uses - Reasonably anticipated future uses as defined in §75-10-701(18), MCA, means likely future land or resource uses that take into consideration:

- ♦ local land and resource use regulations, ordinances, restrictions, or covenants;

- ♦ historical and anticipated uses of the facility;
- ♦ patterns of development in the immediate area; and
- ♦ relevant indications of anticipated land use from the owner of the facility and local planning officials.

Receptor – Any person, plant, or animal that is or could potentially be adversely affected by a petroleum release. Tier 1 RBSLs are conservative and designed to be protective of the ecological receptors primarily encountered at petroleum release sites. If ecological receptors are the most sensitive species at a given site, the release should not be addressed in Tier 1.

Release - Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of a hazardous or deleterious substance directly into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous or deleterious substance), but excludes releases confined to the indoor workplace environment, the use of pesticides as defined in §80-8-102(30), MCA, when they are applied in accordance with approved federal and state labels, and the use of commercial fertilizers, as defined in §80-10-101(2), MCA, when applied as part of accepted agricultural practice (§75-10-701, MCA).

Residential property – Any property used as a place of residence. Residential properties also used for businesses are considered residential. Residential properties that include other uses not defined here are evaluated on a case-by-case basis.

Responsible party (RP) - An owner, operator, generator, transporter, or other person responsible for cleanup of a petroleum release.

Risk-based corrective action (RBCA) - A decision-making process based on the protection of public health, safety and welfare, and the environment, which results in the consistent assessment, remediation and/or closure of petroleum releases.

Risk-based screening level (RBSL) - A chemical concentration considered acceptable for a given exposure scenario based on estimated risk to potential receptors.

RP - See responsible party.

Screening levels - See risk-based screening level.

Tier 1 - The simplest level of RBCA for petroleum releases in Montana. In Tier 1 RBCA, petroleum contaminant levels are compared to predetermined RBSLs for COCs to determine whether additional investigation and/or cleanup is necessary. It involves situations where the petroleum contaminant is confined to soil and/or is present in the groundwater in concentrations below WQB-7 human health standards or groundwater RBSLs. Activities that may be conducted to achieve Tier 1 RBSLs include limited over-excavation or some other remedial procedure. Deeper vertical sampling (soil borings or test pits) may produce less contaminated samples that can also be utilized in the Tier 1 process. The Tier 1 process may not be applicable to sites where site-specific cleanup levels have already been chosen or will be identified through a permit or order.

Volatile petroleum hydrocarbons (VPH) - A group of petroleum hydrocarbons that includes the non-target petroleum fractions typically found in gasoline and other lighter petroleum products. VPH is also the analytical method developed by the Massachusetts Department of Environmental Protection to determine the fractional composition of these non-target compounds.

VPH - See volatile petroleum hydrocarbons.

WQB-7 - See Circular WQB-7.

TIER 1 RISK-BASED CORRECTIVE ACTION EVALUATION PROCESS

Overview of Risk-Based Corrective Action

This document describes the Montana Department of Environmental Quality's (DEQ) Tier 1 risk-based corrective action (RBCA) evaluation process. It provides a description of the concepts and terms that must be understood to use RBCA for petroleum releases in Montana, and is not intended to address other chemical (non-petroleum) releases. This document is applicable to all petroleum releases addressed by DEQ's Petroleum Release Section and Enforcement Division and those petroleum releases addressed by DEQ's Remediation Division under the Water Quality Act. In addition, this guidance may be used as a screening tool for DEQ's Superfund sites and it may be possible to apply Tier 1 to new releases at hazardous waste sites that are covered by existing permits or orders. For hydrocarbon compounds not specifically addressed in this document, a site-specific approach may be developed in consultation with DEQ. The appropriate regulating agency or Bureau should be contacted to determine whether Tier 1 is appropriate.

RBCA Focuses on Risk Evaluation

The goal of RBCA is to reduce risks to public health, safety and welfare, and to the environment. RBCA uses environmental risk analysis, which incorporates elements of toxicology, hydrogeology, chemistry, and engineering to assess the existing and potential risks from a petroleum release. This information is used to develop cleanup levels that reduce those risks to levels determined to be acceptable in the State of Montana.

DEQ's Tier 1 site evaluation process consists of assessing site conditions and maximum contaminant concentrations, and choosing the appropriate Tier 1 risk-based screening levels (RBSLs) to determine whether further remedial action is needed to close the release. Tier 1 RBSLs denote contaminant concentrations that represent acceptable risks to human health and the environment. When soil and groundwater samples taken from a site contain contaminant concentrations that do not exceed the appropriate Tier 1 RBSLs, the release is ready to be considered for closure under the Tier 1 process.

Chemicals of Concern

Petroleum products are made up of a large number of chemical constituents that may be harmful to the public health, safety and welfare, and to the environment. Risk analysis focuses on the presence of chemicals of concern (COCs) at contaminated sites. DEQ has identified several common petroleum constituents as COCs generally applicable to petroleum releases. This list includes methyl tertiary-butyl ether (MTBE), benzene, toluene, ethylbenzene, xylenes, naphthalene, volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons

(EPH)¹, and polycyclic aromatic hydrocarbons (PAHs). Soil and water samples from petroleum release sites are analyzed for these COCs during a Tier 1 evaluation. Other COCs may be included based on site activities. Any additional COCs will be identified by the appropriate regulating agency or Bureau and evaluated outside the Tier 1 process.

Exposure Pathways

COCs move through the environment via exposure pathways. A complete exposure pathway includes a contaminant source, an exposure route, and an exposure point. Sources of petroleum contamination include storage tanks, piping, and surface spills, including spills from trucks or other transport containers. Petroleum-contaminated soil, such as that remaining beneath a leaking underground storage tank (UST) or pipe, can also be a contaminant source that contributes to an on-going release to adjacent soil and groundwater. An exposure route can be any avenue COCs might follow from petroleum sources to receptors. Contaminants can spread through the soil, surface water, groundwater, and air, and can accumulate in vegetation, animals, and other organisms. COCs are spread by many processes, including advection, dispersion, diffusion and volatilization. Exposure pathways can include natural or man-made processes and media, and can be direct or indirect. Receptors are typically exposed to COCs at exposure points through ingestion, inhalation, or direct (dermal) contact.

Remedial Actions Under RBCA

The nature and extent of contamination at petroleum releases are generally characterized through remedial investigations. During these investigations, responsible parties (RPs) and their consultants identify which contaminants are present at a release, and determine their concentrations, and horizontal and vertical distribution. Other site conditions, such as geology, hydrogeology (including determination of site-specific depth to groundwater), local land use, and potential receptors are also documented. This information is evaluated to determine RBCA target cleanup levels for each release (described in more detail below). These target cleanup levels are set to ensure that any COC concentrations that might remain will not pose unacceptable risks to public health, safety and welfare, and the environment.

RBCA cleanup goals can be met by removing contaminated material from the release until COC concentrations meet Tier 1 cleanup levels. However, Tier 1 cleanup levels may also be reached by using combinations of other methods that reduce the potential for exposure. Acceptable methods might include *in situ* treatment technologies, source control or treatment, engineered controls that reduce or restrict migration, or enhancement technologies that promote biodegradation.

Removing or reducing contamination to levels below the RBSLs does not always ensure that contamination has not already leached or migrated downward to the water table. The RBSLs listed in this document, among other purposes, are intended to identify conservative threshold

1. “VPH” and “EPH” are also the names of analytical methods developed by the Massachusetts Department of Environmental Protection to determine the concentrations of these non-target compounds. These new methods break total petroleum hydrocarbons (TPH) into “fractions” that can be used in risk calculations. DEQ now uses these methods in place of GRO (gasoline range organics) and DRO (diesel range organics) analytical methods.

conditions where contamination may leach to groundwater. If soil contamination concentrations are reduced below RBSLs, then leaching should not occur in the future. However, if contamination exceeded RBSLs in the past, then the leaching process may have already taken place. This has been particularly evidenced in porous soils and at locations where releases have been present for long periods of time. Therefore, achieving RBSLs does not preclude the need to investigate groundwater to determine whether it has already been contaminated. In some cases contamination may have leached downward and formed a smear zone of contamination within the soil between the seasonal high and low water levels of an aquifer. These smear zones then act as a secondary source of groundwater contamination. In determining whether a groundwater investigation is necessary many factors including the age of the release, porosity of the soil, the depth to groundwater, maximum soil contaminant concentrations originally present, estimated mass of the release, and estimated mass of contamination removed or destroyed, as well as other site-specific parameters that must be evaluated.

Tier 1 Data Collection and Evaluation

The RBCA process is broken into tiers or stages. The lowest level of complexity of RBCA is Tier 1. Tier 1 is appropriate for simple releases that can be cleaned up easily with minimal information. In the Tier 1 process, RPs or their consultants follow guidelines to complete forms that provide DEQ with the information necessary to determine what corrective action is necessary, and whether a release can be evaluated for closure without further action.

More complicated releases require more extensive investigation, data collection, and analysis to fully assess the risk and address the contamination. Under Montana's RBCA program, these will typically include releases where surface water or groundwater are contaminated at concentrations above groundwater RBSLs (including WQB-7 human health standards), or releases with extensive soil contamination that cannot practically be dealt with under Tier 1. An example of the latter situation would be a release with gasoline-contaminated soil, where there exists a threat of vapor migration into nearby structures or dwellings. RBCA Tiers 2 and 3 are generally intended for use at more complex releases to develop site-specific cleanup goals. DEQ has not yet developed Tiers 2 or 3, but is continuing to evaluate alternatives for their application in Montana. In addition, Tier 1 may not be appropriate for releases where site-specific cleanup levels have been established under the authority of a permit or order. The appropriate regulating agency or Bureau must be consulted to determine whether Tier 1 may be applied at these releases.

Documenting Site Conditions

For releases associated with USTs, site conditions are documented on the 24-Hour Release Report and 30-Day Release Report forms published by DEQ. Blank copies of these reports have been included in Appendix A as examples of the type of information DEQ will require. DEQ staff complete the 24-Hour Release Report form over the telephone when an RP reports the discovery of a release. The 30-Day Report form, provided by DEQ after a release is reported, is completed by the RPs within 30 days of the release notification. The DEQ Enforcement Division uses a Complaint/Spill Report to document initial information about a release (see

Appendix B). This form is typically completed by DEQ staff. Other regulating agencies or Bureaus have their own reporting requirements. For releases that are not associated with USTs, the appropriate regulating agency or Bureau should be contacted to determine reporting requirements.

DEQ uses the information and laboratory analytical data provided by the RP to determine whether a release qualifies for closure under Tier 1. Some site conditions, such as when petroleum contaminants are present in the groundwater at levels which indicate COC concentrations exceed WQB-7 human health standards or groundwater RBSLs, when petroleum vapors are detected in basements, or when a petroleum plume is moving off site, automatically disqualify a release from closure under Tier 1. In such cases, DEQ will require that more information be gathered to develop release cleanup and management strategies, and target cleanup levels. Such releases generally require more comprehensive investigations to determine the complete extent and magnitude of the contamination.

Soil Sampling Requirements

Soil samples must be collected from any confirmed or suspected contamination. Soil samples must be representative of worst-case areas, such as beneath leaking USTs, surface spills or other likely sources of petroleum contamination. The appropriate regulating agency or Bureau should be contacted to determine the appropriate sampling requirements for the site. Although decisions should be made on a site-specific basis, Appendix F provides guidance on the general sampling requirements of the DEQ Hazardous Waste Site Cleanup Bureau. Samples associated with UST sites must be submitted to DEQ-approved laboratories for analysis according to the laboratory methodologies specified in Table A (see page 5). The EPH and VPH analytical methods, developed by the Massachusetts Department of Environmental Protection, will be used for all RBCA Tier 1 evaluations in Montana. Soil sample locations and other pertinent site history data must be recorded and submitted to DEQ. All analytical results and associated laboratory documentation must be submitted to DEQ as part of the standard reporting process for any phase of site assessment or remediation.

Table A outlines the analytical methods DEQ requires for individual petroleum products in soil. In order to reduce the analytical costs for the EPH analysis, DEQ is using a two-step screening technique to evaluate soils at sites where the EPH analysis is appropriate. The first step in the screening technique is similar to the DRO analysis and generates a total extractable hydrocarbon (TEH) concentration. If the initial screening result is 50 parts per million (ppm) or less, no additional analysis is required. However, if the TEH concentration is greater than 50 ppm further analysis will be required. VPH analysis is required to determine the concentrations of MTBE, BTEX, naphthalene (MBTEXN) and other light range hydrocarbons present in the soil and the EPH fractionation step will also be required. PAH analysis may be required on a site-specific basis if heavy hydrocarbons, refinery wastes or unknown oils/sources may be present.

Table A - Testing Procedures for Soils				
Petroleum Product	VPH	EPH Screen	EPH Fractionation	EPH for PAHs
Gasoline	R			
Diesel #1	X	R	X	
Diesel #2	X	R	X	
#3- #6 Fuel Oils		R	X	
Waste Oil	X	R	X	SS
Jet Fuel/Kerosene	X	R	X	
Mineral/Dielectric Oils		R	X	
Heavier Wastes		R	X	X
Crude Oil	R	R	X	X
Unknown Oils/Sources	R	R	X	SS

R- required analysis

X - analysis to be run if the EPH screen concentration is >50 ppm TEH

SS – Site-specific determination. Analysis may be required if the EPH screen concentration is >50 ppm TEH.

Groundwater Sampling Requirements

At some sites it may be necessary to collect groundwater samples to verify that contaminant concentrations are below RBSLs and WQB-7 human health standards. Groundwater samples must also be collected from worst-case areas. Appendix F provides guidance on the general sampling requirements of the DEQ Hazardous Waste Site Cleanup Bureau. MBTEXN and other lighter range hydrocarbons are commonly detected at gasoline and diesel release sites at concentrations that exceed human health standards. The VPH Method includes these compounds but the EPH Method does not. Consequently, VPH analysis will be required in addition to the EPH Method at all diesel, kerosene, jet fuel, and waste oil release sites to determine MBTEXN concentrations. Table B outlines the analytical methods DEQ requires for individual petroleum products in groundwater.

To reduce analytical costs, DEQ uses the EPH screening technique. The screening technique approach is similar to that described above for soils and generates a TEH concentration. If the initial screening result is 300 parts per billion (ppb) TEH or less, EPH fractionation is not required. VPH analysis is also required initially for some compounds. If the TEH concentration exceeds 300 ppb, fractionation may be required and the site must be addressed outside the Tier 1 process. More than one sampling event may be required to verify this. PAH analysis using EPA Method 8270 will be required for refinery wastes and other heavy hydrocarbons regardless of the screening concentration.

Table B - Testing Procedures for Groundwater				
Petroleum Product	VPH	EPH Screen	EPH Fractions	EPA Method 8270 for PAHs
Gasoline	R			
Diesel #1	R	R	SS	SS
Diesel #2	R	R	SS	SS
#3- #6 Fuel Oils		R	SS	SS
Waste Oil	R	R	SS	SS
Jet Fuel/Kerosene	R	R	SS	SS
Mineral/Dielectric Oils		R	SS	SS
Heavier Wastes		R	SS	R
Crude Oil	R	R	SS	SS
Unknown Oils/Sources	R	R	SS	SS

R - required analysis

SS – Site-specific determination. Analysis may be required if the EPH screen concentration is >300 ppb TEH.

The Tier 1 Evaluation

The Tier 1 RBSL lookup tables contain target cleanup levels for surface soil, subsurface soil, and groundwater (see Tables 1, 2, and 3). These tables are arranged in categories that reflect different site conditions. To determine the appropriate RBSLs, the RP (or its consultant) and DEQ staff match the values in the categories of the tables that correspond with the conditions present at the site.

For the purposes of Tier 1 evaluation, contaminated soil is classified either as “surface soil” lying two feet or less below the ground surface, or as “subsurface soil,” buried more than two feet below ground surface. Tier 1 RBSLs for contaminated soil are divided into three categories depending on the distance to groundwater beneath that contaminated soil: 1) soil less than ten feet above groundwater, 2) soil between ten and twenty feet above groundwater, and 3) soil greater than twenty feet above groundwater. The distance to water is determined using the depth to water measured during high water conditions in a well screened in the uppermost zone of saturation within 500 feet of the release. The two criteria used to determine the appropriate set of Tier 1 RBSLs for a particular site are: 1) known depth below the ground surface of contaminated soil and 2) known distance to groundwater below contaminated soil.

DEQ and the RP must also consider the current and reasonably anticipated future use of sites with contaminated surface soil. The site may be designated commercial or residential by taking into account past, current, and potential future uses of the site, zoning, and other relevant factors. Residential sites are those where someone resides or may reside in the future at the site and commercial sites are those without residents used only for commercial/industrial purposes. This determination is only relevant for petroleum-contaminated surface soil. When site conditions are not well defined, DEQ uses the most conservative soil RBSLs, corresponding to the shallowest depth to groundwater below contaminated soil with residential use.

To be considered for closure under Tier 1, soil and groundwater samples from a site must not contain COC concentrations that exceed the appropriate Tier 1 RBSLs. DEQ regards a release

as a “closed petroleum release” when Tier 1 RBSLs are met and it is clear from other information that no further cleanup action is necessary.

Should COC concentrations exceed the values in the appropriate Tier 1 RBSL Lookup Table(s), the release is not ready to be closed under the Tier 1 process. However, it may be possible to remediate a release to Tier 1 RBSLs by removing more contaminated material (e.g., through further excavation or *in situ* remedial techniques), then resampling and following the Tier 1 evaluation process again. Releases that cannot be closed under the Tier 1 evaluation process, including those with COCs in groundwater above the WQB-7 human health standards or Tier 1 RBSLs (Table 3), will require further remedial action before they can be closed.

Summary of Tier 1 Procedures

Procedures for evaluating a release using RBCA Tier 1 are summarized as follows:

- Based on field screening results, initiate site assessment and appropriate interim corrective action (including soil removal or free product abatement activities in the source area).
- Determine if a petroleum release is confirmed.² At UST sites gasoline range and lighter compound releases are confirmed when pre- or post excavation soil analytical results exceed the RBSLs in the first numeric column of the Tier 1 Surface Soil RBSL Table (Table 1). Diesel range and heavier compound releases are confirmed when pre- or post-excavation soil analytical results exceed 50 ppm TEH at UST sites.
- Upon receipt of confirmation of a petroleum release, the RP must notify the appropriate DEQ Bureau of the release within the time specified by the Bureau.
- Based on the sample depth and distance to groundwater, find the appropriate RBSL value in the Tier 1 tables.
 - ♦ If the post-excavation sample depth is two feet or less, the sample represents surface soil and the Tier 1 Surface Soil RBSLs (Table 1) apply.
 - ♦ If the sample represents surface soil, the appropriate land use must be determined.
 - ♦ If anyone lives at the site or may live at the site in the future, residential RBSLs apply to surface soil.
 - ♦ If the site is used as a place of business with employees present regularly and no one lives at the site, commercial RBSLs apply to surface soil.
 - ♦ If the post-excavation sample depth is greater than two feet, the sample represents subsurface soil and the Tier 1 Subsurface Soil RBSLs (Table 2) apply.
 - ♦ For both types of soil, if groundwater at the site is less than ten feet below the sample location, the first set of RBSLs apply (left hand column(s)).
 - ♦ For both types of soil, if groundwater at the site is between ten and twenty feet below the sample location, the second set of RBSLs apply (middle column(s)).
 - ♦ For both types of soil, if groundwater at the site is greater than twenty feet below the sample location, the third set of RBSLs apply (right hand column(s)).

2. Different regulations may have different reporting requirements. Montana regulations require reporting of all UST-related releases of 25 gallons or greater or any size UST-related release that is not remediated within 24 hours. (ARM 17.56.505).

- If worst-case soil sampling results are less than the appropriate RBSL value, the release may be evaluated for closure.
- If necessary and appropriate, conduct additional remediation or investigation.
- Following removal of additional soil or *in situ* remediation, compare soil confirmation sampling results with RBSLs on the Tier 1 Tables.
- If worst-case soil sampling results are less than the appropriate RBSL value, the release may be evaluated for closure.
- At any point in the process if groundwater sampling results or site conditions indicate that groundwater is impacted, compare the site data to the Tier 1 groundwater RBSLs (Table 3) to evaluate groundwater sampling results. More than one sampling event may be required for a complete evaluation.
- If groundwater sampling results exceed the Tier 1 groundwater RBSLs (Table 3) the release cannot be closed under the Tier 1 RBCA process, and a groundwater investigation must be completed.
- Within 30 days of a release from a UST, the RP must submit a completed 30-Day Release Report form to the DEQ Petroleum Release Section. Other agencies or Bureaus may have other reporting requirements.
- If soil sampling results exceed RBSLs, complete initial site assessment and corrective action based on site conditions and according to a DEQ-approved corrective action plan.

Figure 1 is a flowchart showing the RBCA Tier 1 process for a typical UST site addressed by the DEQ Petroleum Release Section.

Development of Tier 1 Lookup Tables

DEQ calculated Tier 1 RBSLs for exposure pathways commonly associated with petroleum releases. RBSLs for surface soil were calculated for the soil leaching to groundwater pathway, and for the direct-contact pathway assuming residential and commercial land use. RBSLs for subsurface soil were calculated for the soil leaching to groundwater pathway, and for the direct contact pathway to account for exposure of receptors during any excavation/construction at a site. Additionally, RBSLs for non-target COC fractions in soil include beneficial use (aesthetic) considerations. For each of the three distance to groundwater categories in Tables 1 and 2, the RBSLs DEQ published reflect the lowest COC concentration calculated for any possible exposure scenario (i.e., for the soil leaching to groundwater pathway, through direct contact, or based on beneficial use considerations). Appendix C is a comprehensive soil RBSL table presenting the RBSLs calculated for direct contact, leaching to groundwater, and beneficial use considerations.

Tier 1 RBSLs for groundwater in Table 3 consist of WQB-7 human health standards for the individual (target) COCs. For the non-target petroleum fractions, direct contact RBSLs were calculated using the fraction-surrogate approach and compared to beneficial use criteria, and the lowest target value for each fraction was used in Table 3.

Derivation of RBSLs

Tier 1 RBSLs were calculated using chemical fate and transport models, exposure models, and data characterizing the mobility, toxicity, and aesthetics of petroleum compounds. The contaminant transport models simulate chemical movement from a release source to underlying groundwater, and incorporate conservative assumptions regarding soil type, the rate of water infiltration, and the behavior of the COCs. Contaminant transport modeling results were used to calculate soil target levels protective of groundwater RBSLs (including WQB-7 human health standards). Exposure modeling was performed to characterize potential risk from direct contact with contaminated soil, including ingestion, inhalation, and dermal contact exposure routes, and contact with groundwater, including ingestion and inhalation.

Refined petroleum products are typically mixtures of organic chemicals, many of which do not have WQB-7 human health standards. The Groundwater RBSL Table (Table 3) includes WQB-7 human health standards for target COCs for which standards were available.

RBSLs for the non-target ranges of petroleum hydrocarbons were developed using a fraction-surrogate approach because WQB-7 human health standards were not available. These petroleum constituents are divided into fractions (e.g., C5-C8 aliphatics) based on chemical behavior and toxicity. RBSLs were calculated using a chemical representative (“surrogate”) for each fraction. Groundwater RBSLs were developed for each petroleum fraction based on the toxicity and aesthetic qualities of each surrogate chemical. Toxicity values were combined with exposure parameters used to estimate ingestion and inhalation exposure to the COCs in groundwater to develop RBSLs based solely on risk to human health. These parameters were similar to those used to develop WQB-7 human health standards. Information about taste and odor thresholds for these COCs in groundwater was obtained from other states and used to develop RBSLs based on protection of the beneficial use of the groundwater. DEQ also considered the lowest reasonably achievable practical quantitation limit in setting RBSLs for the petroleum fractions.

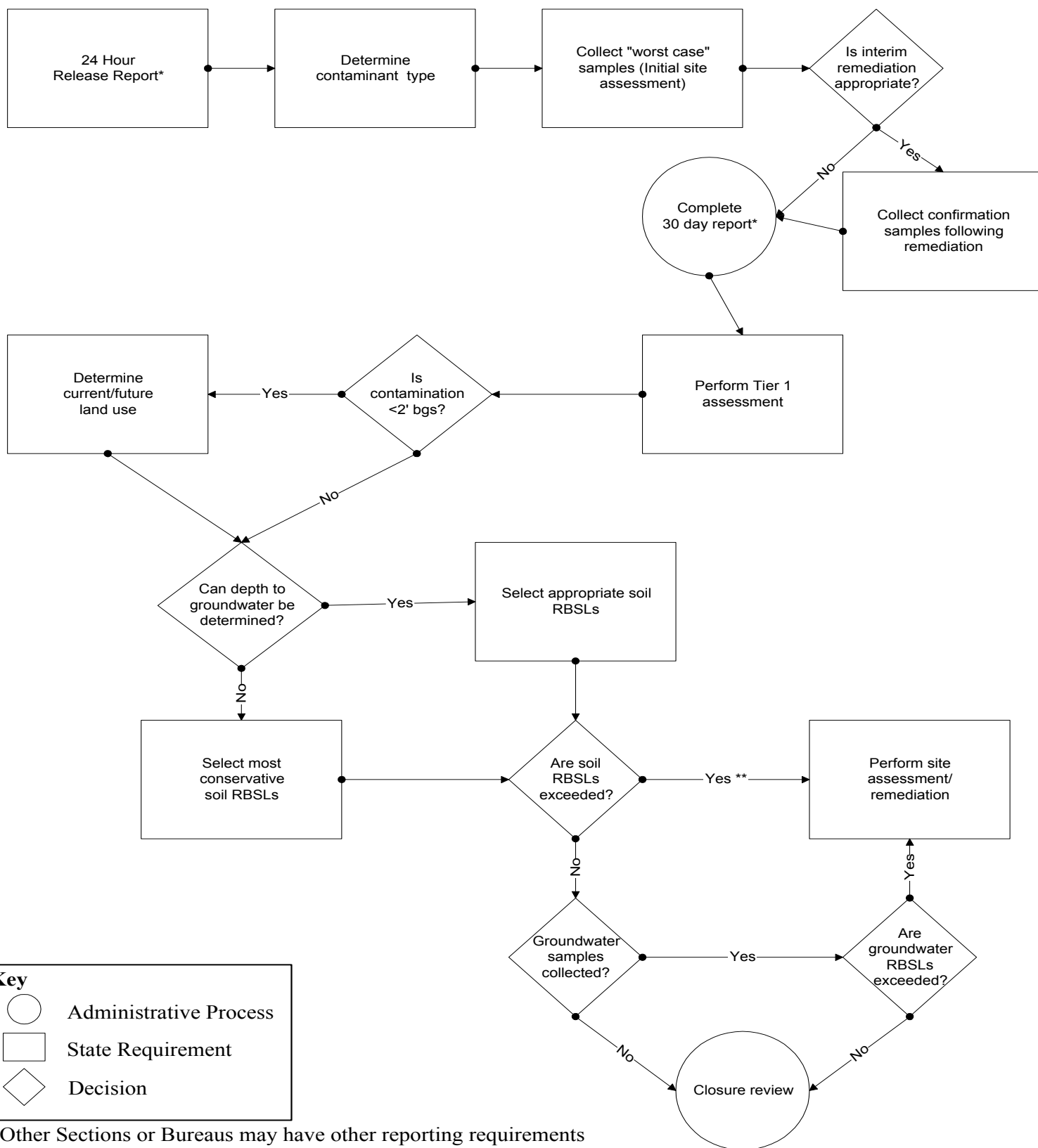
Soil RBSLs were calculated for each petroleum fraction using the chemical fate and transport model used for the target compounds. These soil RBSLs are designed to be protective of groundwater below releases, so that contaminants leaching from contaminated soil will not cause groundwater to exceed groundwater RBSLs. Ceiling concentrations were also developed to assure that total concentrations of all non-target COCs do not interfere with the beneficial uses of the soil or groundwater.

Conservative, generic estimates of physical, chemical, and exposure parameters were used to develop the Tier 1 RBSLs. These generic estimates produce RBSLs with built-in safety margins, to compensate for the limited site-specific information typically available at Tier 1. The conservative Tier 1 RBSLs were created using several generic “worst-case” assumptions for model parameters.

Models Used to Generate Tier 1 RBSLs

DEQ staff calculated Tier 1 RBSLs for the soil leaching to groundwater pathway using the “VS2DT Solute Transport in Variably Saturated Porous Media” model (United States Geological Survey), combined with the “Hydrologic Evaluation of Landfill Performance” (HELP) model, which was used to estimate water infiltration rates. Direct contact RBSLs were calculated using equations developed by the United States Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection. The specific assumptions used in DEQ’s Tier 1 soil leaching to groundwater models are discussed in Appendix D. The assumptions used in the direct contact modeling, including those associated with the fraction-surrogate approach, are discussed in Appendix E. Information regarding the beneficial use criteria is also provided in Appendix E. Since Tier 1 RBSLs are intended for use at a variety of releases throughout the state, the assumptions of Tier 1 provide for a wide margin of safety, and are therefore conservative.

Figure 1 --- RBCA Tier 1 PRS Decision Tree



Appendix A

Tier 1 RBCA

24-HOUR AND 30-DAY UST RELEASE REPORTS

Appendix B

Tier 1 RBCA

ENFORCEMENT DIVISION COMPLAINT/SPILL REPORT

Appendix C

Tier 1 RBCA

MASTER TABLE OF POTENTIAL TIER 1 VALUES

Appendix D

Tier 1 RBCA

VADOSE ZONE MODELING TECHNICAL SUPPORT DOCUMENT

Appendix E

Tier 1 RBCA

DIRECT CONTACT TECHNICAL SUPPORT DOCUMENT

Appendix F

Tier 1 RBCA

TECHNICAL MEMORANDUM: APPLICATION OF THE MASSACHUSETTS METHOD IN FACILITY CHARACTERIZATION